

What is claimed is:

1. An isolated nucleic acid molecule comprising a nucleic acid, which corresponds to BMP-2 regulatory region, comprising an estrogen responsive element.
- 5 2. A vector comprising the nucleic acid according to claim 1, wherein the nucleic acid is operably linked to a second nucleic acid.
3. A host cell comprising the vector of claim 2.
- 10 4. The host cell of claim 3, wherein the cell further comprises an estrogen receptor.
5. The host cell of claim 4, wherein the estrogen receptor is α .
- 15 6. The host cell of claim 4, wherein the estrogen receptor is β .
7. A method for the identification of a therapeutic agent for the prevention and/or treatment of osteoporosis, comprising:
 - (a) introducing into a cell the vector of claim 2;
 - 20 (b) contacting the cell with a candidate agent; and
 - (c) monitoring the expression of the protein encoded by the reporter nucleic acid, wherein induced expression of the protein indicates that the candidate agent is a potential therapeutic agent.
- 25 8. The method of claim 7, wherein in step (a) a second expression vector comprising a nucleic acid molecule encoding an estrogen receptor is introduced into the cell.
9. The method of claim 8, wherein the estrogen receptor is α .
- 30 10. The method of claim 8, wherein the estrogen receptor is β .

11. A method of regulating expression of BMP-2 in a subject comprising the steps of: administering the vector of claim 2, wherein said second nucleic acid encodes for the BMP-2; and administering to the subject an effective amount of estrogen or estrogen agonist; thereby regulating expression of BMP-2 in the subject.

5

12 A method of regulating expression of BMP-2 in a subject comprising the steps of: administering to the subject an effective amount of the cell of claim 3, wherein the a second nucleic acid encodes for BMP-2; and administering to the subject in need an effective amount of estrogen or estrogen agonist; thereby regulating expression of BMP-2 in the subject.

10

13 The method of claim 12 wherein the cell is a mesenchymal stem cell, a progenitor cell, or a cell capable of differentiating into an osteoblast cell.

15

14. A method of increasing responsiveness of a cell to an estrogen or estrogen agonist comprising the step of administering the vector of claim 2; thereby increasing the responsiveness of the cell to estrogen.

15. The method of claim 14, wherein the cell comprises an estrogen receptor.

20

16. The method of claim 14, wherein the cell is a mesenchymal stem cell, a progenitor cell, or a cell capable of differentiating into an osteoblast cell.

25

17. A method of enhancing repair of a bone in the body in a subject in need comprising the steps of: administering the vector of claim 2; and administering to the subject in need an effective amount of estrogen or estrogen agonist; thereby enhancing repair of the bone in the body of the subject in need.

30

18. A method of enhancing repair of a bone comprising the steps of: administering to a subject an effective amount of the cell of claim 3; and administering to the subject in need an effective amount of estrogen or estrogen agonist; thereby enhancing repair of the bone in the subject.

19. The method of claim 18, wherein the cell is a mesenchymal stem cell, a progenitor cell, or a cell capable of differentiating into an osteoblast cell.

20. A method for maintaining or increasing bone volume, bone quality, or bone strength in a subject in need afflicted with osteoporosis caused by or accompanied by a decrease in estrogen comprising the steps of: administering the vector of claim 2; and administering to the subject in need an effective amount of estrogen or estrogen agonist; thereby maintaining or increasing bone volume, bone quality, or bone strength in the subject in need.

10

21. A method for maintaining or increasing bone volume, bone quality, or bone strength in a subject in need afflicted with osteoporosis caused by or accompanied by a decrease in estrogen comprising the steps of: administering to a subject an effective amount of the cell of claim 3; and administering to the subject in need an effective amount of estrogen or estrogen agonist; thereby maintaining or increasing bone volume, bone quality, or bone strength in the subject in need.

15

22. The method of claim 21, wherein the cell is a mesenchymal stem cell, a progenitor cell, or a cell capable of differentiating into an osteoblast cell.

20

23. A method of enhancing repair of a bone in the body in a subject in need comprising the steps of: obtaining a cell from the subject; transfecting the cell with the vector of claim 2; administering the engineered cell to the subject; and administering to the subject in need an effective amount of estrogen or estrogen agonist; thereby enhancing repair of a bone in the body in the subject in need.

25

24. A method for maintaining or increasing bone volume, bone quality, or bone strength in a subject in need afflicted with osteoporosis caused by or accompanied by a decrease in estrogen comprising the steps of: obtaining a cell from the subject; transfecting the cell with the vector of claim 2; administering the engineered cell to the subject; and administering to the subject in need an effective amount of estrogen or estrogen agonist; thereby maintaining or increasing bone volume, bone quality, or bone strength in a subject in need.

30

25. The method of claim 24, wherein the step of administering to the subject in need an effective amount of estrogen or estrogen agonist further increase the level of expressed BMP 2 by 1.5-30 fold.

5

26. The method of claim 24, wherein the cell is a mesenchymal stem cell, a progenitor cell, or a cell capable of differentiating into an osteoblast cell.

27. A method for the production of transplantable bone matrix, the method comprising the steps of: obtaining a cell; transfecting the cell with the vector of claim 2; and culturing the cell with the cell-associated matrix for a time effective for allowing formation of a transplantable bone matrix.

10

28. The method of claim 27, wherein the cell is a mesenchymal stem cell, a progenitor cell, or a cell capable of differentiating into an osteoblast cell.

15

29. A method of stimulating osteoblast differentiation comprising the steps of: administering the vector of claim 2; and administering an effective amount of estrogen or estrogen agonist; thereby regulating expression of stimulating osteoblast differentiation.

20

30. A method of treating a bone disease in a subject comprising the steps of: administering the vector of claim 2; and administering to the subject an effective amount of estrogen or estrogen agonist; thereby treating a bone disease in the subject.

25

31. A method of treating a bone disease in a subject comprising the steps of: administering to the subject an effective amount of the cell of claim 3; and administering to the subject in need an effective amount of estrogen or estrogen agonist; thereby treating a bone disease in the subject.

30

32. The method of claim 31, wherein the cell is a mesenchymal stem cell, a progenitor cell, or a cell capable of differentiating into an osteoblast cell.

33. A method for identifying a compound in a sample as an estrogenic agonist comprising:

(a) providing a cell line expressing receptors for human estrogen, which cell line has been stably transfected by a vector comprising a reporter nucleic acid operatively linked to an isolated nucleic acid corresponding to BMP-2 regulatory region, or a fragment thereof that comprises an estrogen responsive element, wherein said estrogen responsive element is capable of controlling expression of the reporter nucleic acid in response to estrogen;

(b) contacting the transfected cell line with a sample suspected to contain a human estrogen agonist, under conditions in which human estrogen would cause increased expression of the reporter nucleic acid; and

(c) measuring the level of expression of the reporter nucleic acid,

Whereby a human estrogen agonist in the sample is identified by measurement of an increased level of expression of the reporter nucleic acid, compared to the level produced by a buffer control.

34. A method for identifying a compound in a sample as a human estrogen antagonist comprising:

(a) providing a cell line expressing receptors for human estrogen, which cell line has been stably transfected by a vector comprising a reporter nucleic acid operatively linked to an isolated nucleic acid corresponding to BMP-2 regulatory region, or a fragment thereof that comprises an estrogen responsive element wherein said estrogen responsive element is capable of controlling expression of the reporter nucleic acid in response to estrogen;

(b) contacting the transfected cell line with a sample suspected to contain a human estrogen antagonist, to which has been added an amount of human estrogen that, absent such antagonist, would produce a measurable increase in expression of the reporter nucleic acid; and

(c) measuring the level of expression of the reporter nucleic acid,

whereby a human estrogen antagonist in the sample is identified by measurement of a decreased level of expression of the reporter nucleic acid, compared to the level produced by the human estrogen in the absence of such antagonist.